- PATENT -

I **IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICANT:	John Harris	EXAMINER: Wong, W.
SERIAL NO.:	09/973,206	ART UNIT: 2616
FILED:	10/09/01	CASE NO.: CE08991R
ENTITLED:	CONTROL OF JITTER BUFFER SIZE AND DEPTH	

Motorola, Inc.
Corporate Offices
1303 E. Algonquin Road
Schaumburg, IL 60196
April 16, 2007

DECLARATION UNDER 37 C.F.R. § 1.131

Mail Stop Amendment
Commissioner of Patents
P.O. Box 1450
Alexandria, Va. 22313-1450

Commissioner:

Now comes John Harris, who declares and states:

1. That I am the inventor of the subject matter claimed in the above-identified U.S. Patent application.

2. Prior to April 24, 2001, I had completed the invention described and claimed in the above-identified U.S. Patent application, as evidenced by the following facts: Prior to April 24, 2001, while in the course of research and experimentation at Motorola, Inc. ("Motorola"), I had prepared and characterized an invention for determining a jitter buffer depth target as evidenced by a Patent Disclosure form, dated May 21, 2001, that I submitted to Motorola, Inc. A copy of the Patent Disclosure form is attached to this Declaration. Such Patent Disclosure forms are prepared and submitted in accordance with procedures prescribed by Motorola and I hereby confirm that all dates described therein are correct.

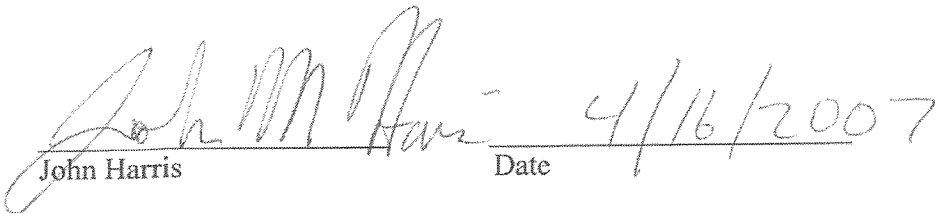
3. As set out in the Patent Disclosure form, one embodiment of my invention provided for determining a jitter buffer depth target comprising steps of determining a radio frequency (RF) load metric corresponding to a base site, comparing the determined RF load metric to an RF load threshold to produce a comparison, and determining a jitter buffer depth target based on the comparison.

3. The date of conception of my invention listed in the Patent Disclosure form, that is, April 14, 2001, and the date listed in the Patent Disclosure form that I disclosed my invention to my manager, Phil Fleming, that is, April 19, 2001, are prior to April 24, 2001, that is, the date of the Kurittu patent application, U.S. patent application publication no. 2004/0120309, cited by the Examiner in rejecting our application in an Office Action dated November 13, 2006.

4. The undersigned Declarant declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under

Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of this application or any patent issuing thereon.

5. Further Declarant saith not.



John Harris Date 4/16/2007

MOTOROLA
Network Solutions Sector

Motorola Confidential Proprietary Upon Completion

MOTOROLA PATENT COMMITTEE

DISCLOSURE FOR PATENT COMMITTEE
Submitted Pursuant to Employment Agreement

For Instructions for Completion Refer to Disclosure Instruction Procedure

Inventor(s) will not fill in Operation Govern

Disclosure No. CE08991 R Date 5-22-01

Patent Committee Action Combine w/8946R

Inventor(s) Name(s) Harris, John

Inventor must fill in items 1 through 13. Items 2 to 7 may require extra sheets. BE SURE that all pages are signed and dated by both the inventor(s) and two witnesses.

1. Name of the invention. (Limit to ten words.)
RLP Resequencing Buffer Sniffing & Jitter Buffer Maintenance for Dispatch

2. State the problem(s) solved by the invention.
See attached Page.

3. Describe the invention, including its operation, purpose and environment. (Use separate sheets as required)
See attached Page.

4. List the closest known technology (attach article, patent, catalog sheet or other documentation).
See attached Page.

5. Improvement(s) over known technology.
See attached Page.

6. What new elements (e.g. components, circuits, process steps) or combination of known elements or software algorithm produced the improvement?
See attached Page.

7. What are the potential applications for use of this invention?
3G IDEN / Dispatch, & WAP and other data services over IS-2000.

8. Conception date? 4/14/01 (Attach earliest log sheets, drawings, etc., to support dates)

9. To whom did you first disclose this invention? Name: Phil Fleming Date: 4/19/01

10. Date the device was first built and tested: Not yet built
Present location of device? N/A

12. Inventor's Full Name: (Type) John M. Harris — Signature — Date 5/24/01 — Social Security No.& Commerce ID 10136477 — 217 11 8332

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1108 W. Dickens Ave. #2,	Chicago,	IL	USA	60614

Citizen of (i.e. U.S., Germany, etc.)	Dept. No.	Phone	Mail drop & Post No.	Employee Status
USA	BC-546	(847)632 4042	IL-27, 2-1G	Permanent X Contractor__

Inventor's Immediate Supervisor	Dept. No.	Phone	Social Security No. & Commerce ID
Phil Fleming	BC-546	(847)632 4295	10133563

DETERMINATION OF LEGAL INVENTORSHIP WILL BE MADE BY THE PATENT DEPARTMENT.

Inventor's signature (IMPORTANT --YOU *MUST* USE YOUR FULL NAME)--NO INITIALS--

Witnesses signatures (TWO WITNESSES ARE REQUIRED). Witness must sign and date this form and all attachments. THE WITNESSES IN SIGNING THIS FORM ATTEST TO THE FACT THAT THEY UNDERSTAND THE INVENTION.

14. Witness Name: (Type) Tony Dean Signature Anthony R. Dean Date 5/21/01 Phone 23652

15. Witness Name: (Type) [illegible] Signature [signature] Date 5/21/01 Phone 2-5188

Items 16 through 24 are to be filled in by the ENGINEERING/PRODUCT MANAGER or above. THE MANAGER IN SIGNING THIS FORM ATTESTS TO THE FACT THAT HE UNDERSTANDS THE INVENTION.

16. What product will this invention be used in? (No code names--use brief description if necessary)

3G IDEN / Dispatch, WAP, and Voice over IS-2000

Does this invention relate to a project/product being developed jointly with an outside company? NO

17. When (was) (will) the first offer for sale of a product incorporating this invention (be) made? Date: __7/1/01 to IDEN 3G?

18. When is the estimated shipping date? 9/2002

19. When (was) (will) the first disclosure outside of Motorola (be) made> How and to whom? No Disclosure Nondisclosure agreement signed? State title and date of publication, if any.

20. What is the market for products incorporating this invention? Be specific and quantitative.

NEXTEL needs to provide dispatch over CDMA 2000 as a data service. However, by making these changes, one can dramatically improve performance of this system, as described in the benefits section of the disclosure. Thus, the business impact of this is very large for the 3G IDEN / Dispatch, WAP, and other data services over IS-2000.

By using this invention:

a. Basic jitter buffer & Jitter buffer reset when speakers switch:
   a) Eliminates the to two 200 msec large gaps in dispatch calls which use retransmissions, enabling the use of RLP retransmissions and thus the reduced RF impact the enable. See Figure 9 and Figure 10.
   b) Prevents the to two 200 msec large gaps in dispatch calls in subsequent speakers, in multi-party dispatch. For example, after Speaker A stops, and Speaker B starts, listener C will experience an additional pair of 200 msec gaps if the speaker switch invention claim is not implemented.

b. Filling jitter buffer after speaker's voice queued while air links are being established.
   a) Allows one to immediately start playing out voice, without waiting at all for the jitter buffer to fill.

c. Force aborts when needed to avoid gaps – Scan into resequencing buffer for bearer traffic.
   a) Enables the benefit of item b. immediately above.
   b) Eliminates long 200 msec gaps when the jitter buffer has run dry.

d. Simple differentiated QoS in RLP – without changing over the air protocol:
   a) Allows one to solve the following problem, without changing the over the air protocol. This is important when signaling and voice share the same link.
      1. Problem: 2 bearer streams, 1 needs retransmissions and 1 does not (or 1 needs more rounds of retransmissions than the other)

e. Bound the resequencing buffer size:
   a) This reduces the jitter buffer size requirement by truncating the tail of the ordered delay distribution of RLP ~ caused by delayed detection (consecutive errors) and NAK timer expansion caused.

21. Who are the potential competitors? What is the possibility this invention will be used by competitors? Which ones? All wireless infrastructure & mobile vendors.. Samsung, Qualcomm (IPR), Lucent, Ericsson

22. Did this invention result from work on a development Contract? (YES) (NO) Contract NO
Who was the contracting party? No
Does the invention include an inventor from a company in a contractual alliance with Motorola? NO
If so, what company? No

Inventor _____ 5/21/01 Witness 1 _____ 5/21/01

Inventor _____ Witness 2 _____ 5/21/01

23. Discuss the business impact that this invention will have on Motorola. Be specific and quantitative.

NEXTEL needs to provide dispatch over CDMA 2000 as a data service. However, by making these changes, one can dramatically improve performance of this system, as described in the benefits section of the disclosure. Thus, the business impact of this is very large for the 3G IDEN / Dispatch, WAP, and other data services over IS-2000.

By using this invention:

f. Basic jitter buffer & Jitter buffer reset when speakers switch:
   a) Eliminates the to two 200 msec large gaps in dispatch calls which use retransmissions, enabling the use of RLP retransmissions and thus the reduced RF impact the enable. See Figure 9 and Figure 10.
   b) Prevents the to two 200 msec large gaps in dispatch calls in subsequent speakers, in multi-party dispatch. For example, after Speaker A stops, and Speaker B starts, listener C will experience an additional pair of 200 msec gaps if the speaker switch invention claim is not implemented.

g. Filling jitter buffer after speaker's voice queued while air links are being established.
   a) Allows one to immediately start playing out voice, without waiting at all for the jitter buffer to fill.

h. Force aborts when needed to avoid gaps – Scan into resequencing buffer for bearer traffic.
   a) Enables the benefit of item b. immediately above.
   b) Eliminates long 200 msec gaps when the jitter buffer has run dry.

i. Simple differentiated QoS in RLP – without changing over the air protocol:
   a) Allows one to solve the following problem, without changing the over the air protocol. This is important when signaling and voice share the same link.
      1. Problem: 2 bearer streams, 1 needs retransmissions and 1 does not (or 1 needs more rounds of retransmissions than the other)

j. Bound the resequencing buffer size:
   a) This reduces the jitter buffer size requirement by truncating the tail of the ordered delay distribution of RLP ~ caused by delayed detection (consecutive errors) and NAK timer expansion caused.

24. Manager's Name (Type)	Signature	Date	Dept. No.	Phone
Phil Fleming		5/20/01	BC-546	847 632 4295

2) Name of the invention. (Limit to ten words.) :

RLP Resequencing Buffer Sniffing & Jitter Buffer Maintenance for Dispatch

3) State the problem(s) solved by the invention:

a. RPL retransmissions lower the RF impact of dispatch calls, but they also cause 2 large audio gaps.
b. Optimizing performance of a system which uses retransmissions with a streaming application with a delay requirement, requires a number of modifications to RLP and the way it interacts with the streaming application. These modifications principally improve

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the audio quality, the delay (or alternatively the RF impact visa the FER tolerable for a given audio quality).

Background:

NEXTEL needs to provide dispatch over CDMA 2000 as a data service. However, this requires that both the SIP messages, and the voice bearer go through RLP. RLP must do retransmissions on the entire stream, or it must retransmission on none of the stream.[1]

If it uses no retransmissions, for the entire call, then the SIP call setup delay can be very large. See Figure 1. In contrast, using retransmissions during the entire call, reduces the SIP delay and allows one to use a higher FER, decreasing the RF impact (even after accounting for the extra retransmissions)

Definitions:

1) Speaker Link: This is the RF link to and from the speaker mobile in a dispatch call.
2) Listener Link: This is the RF link to and from the listener mobile in a dispatch call.
3) RLP Scheme:
   a. $(k_1, k_2, \ldots, k_5)$ where k_i can be 1, 2, …, 5
   b. k_i NAKs are sent in retransmission round I
   c. each NAK correctly received causes a retransmission.
   d. (2, 3, 0, 0, 0), (1, 2, 3, 0, 0) or (1, 2, 0, 0, 0) are typical.
      i. (2, 3, 0, 0, 0) is used in IS-95B HSD. This scheme results in smaller delay, but more retransmissions. The lower delay is needed for HSD (High speed Data) in IS-95B for a number of reasons that are outside of the scope of this document.
      ii. (1,2, 3, 0, 0) is used in IS-95B LSD (Low speed Data). This scheme results in less retransmissions – at the expense of higher delay.
      iii. The (1,0,0,0,0) scheme is generally the best if one is trying to minimize the length of the jitter buffer required. However, if parallelism is used to fill the jitter buffer prior to the link being built, then the (1,2, 3, 0, 0) is better. Note (1,0) scheme is synonymous with (1,0)
4) Gap:
   a. Audio stops & then restarts where it left off.
   b. "Do not place the order" → "Do n ot place the order ".
5) Hole:
   a. A portion of the audio is simply lost.
   b. "Do not place the order" → "Do the order ".
   c. "I am at three two one Pennsylvania Avenue" → "I am at three Pennsylvania Avenue"
6) Big Gaps: These are the gaps that are caused by RLP output rate dropping to zero while it waits for a retransmission. The total big gaps in a system using the (1,0) RLP scheme is roughly 600 millisecs. This includes the Big Gaps caused by the RLP instances on both the speaker's and listener's links. See Figures Figure 7, Figure 8, and Figure 9.
   a. In other words, Large Gaps are roughly 180 to 300 milliseconds & are caused while re-sequencing queue fills up for first time.
7) 200 Millisecs of Voice: Consider: "One one-thousand"
   a. Requires 1 second to say.
   b. Has 4 syllables: "One one thou-sand"
   c. Each syllable is roughly 200 milliseconds, with 100 milliseconds between syllables.

[1] It can also try and switch modes/no with retransmissions to without retransmissions mid stream. However, that can result in a 450 millisecond RLP renegotiation delay.

Inventor _____ 5/21/01 Witness 1 Anthony R. Dean 5/21/01

Inventor _____ Witness 2 _____ 5/21/01

d. Thus, about 1 syllable (often this is an entire word) is lost.

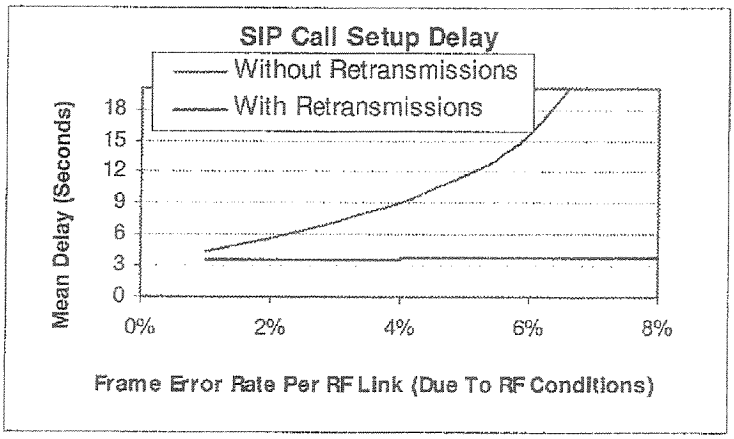

Figure 1: SIP Call Setup Delay [Majumdar & Harris]

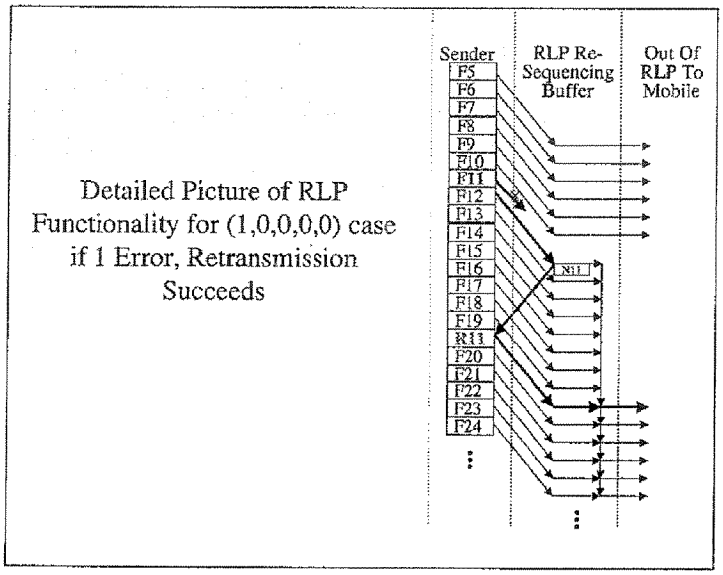

Figure 2 Detailed Picture of RLP Functionality for (1,0,0,0,0) case if 1 Error, Retransmission Succeeds

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Inventor _____ Witness 2 _____ 5/24/01

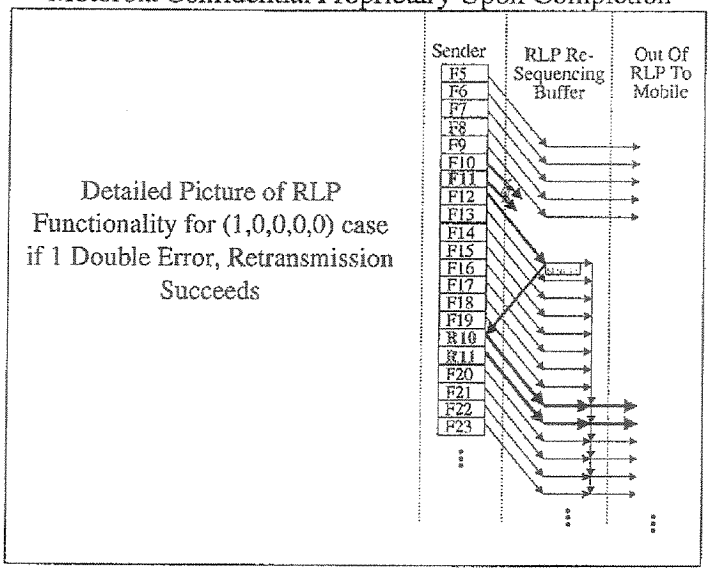

Figure 3: Detailed Picture of RLP Functionality for (1,0,0,0,0) case if 1 Double Error, Retransmission Succeeds

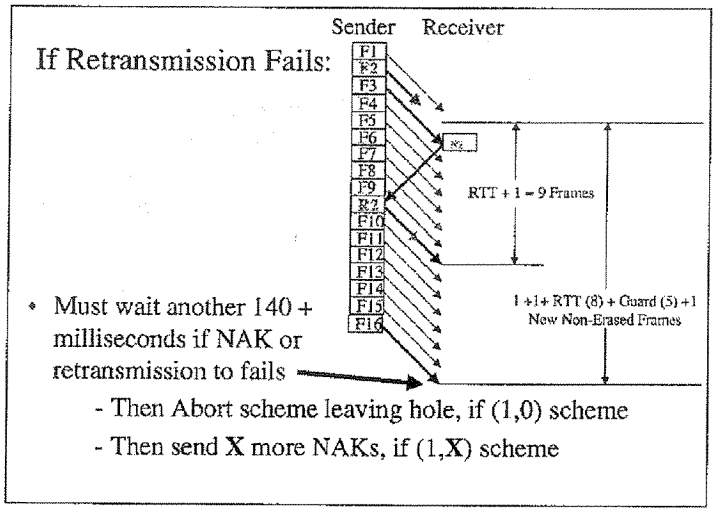

Figure 4: Detailed Picture of RLP Functionality for (1,*) case if 1 Error, Retransmission Fails

Inventor _____ 5/21/01 Witness 1 _____

Inventor _____ Witness 2 _____ 5/21/01

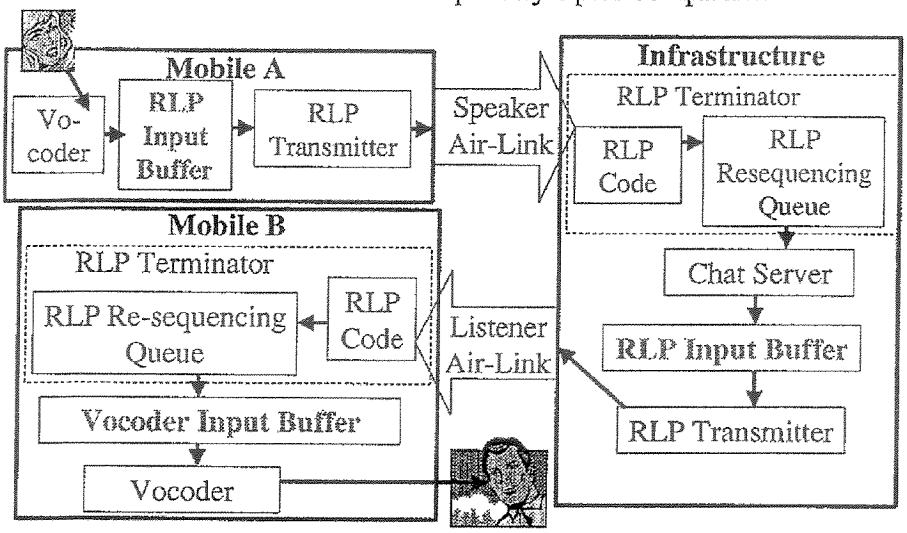

Figure 5: Example System Block Diagram with An emphasis on RLP

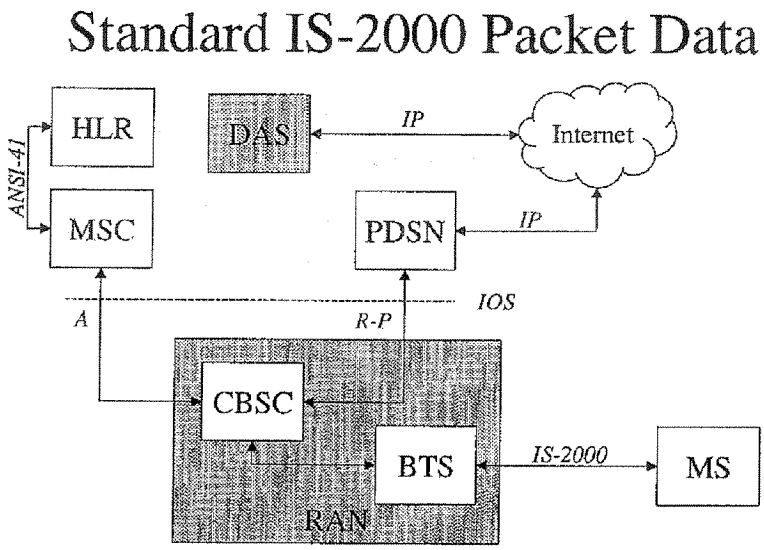

Figure 6: Example System Block Diagram [Picture Drawn by Crocker]

Inventor 5/2/01 Witness 1

Inventor Witness 2 5/21/01

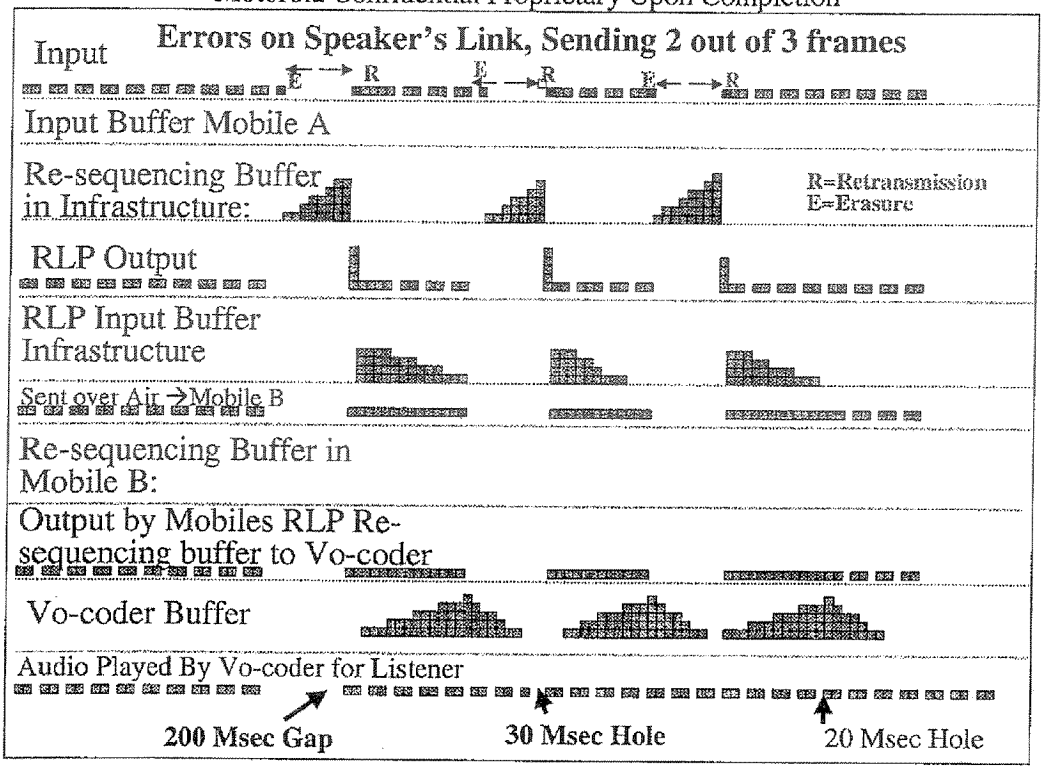

Figure 7: Errors on Speaker's Link, Sending 2 out of 3 frames

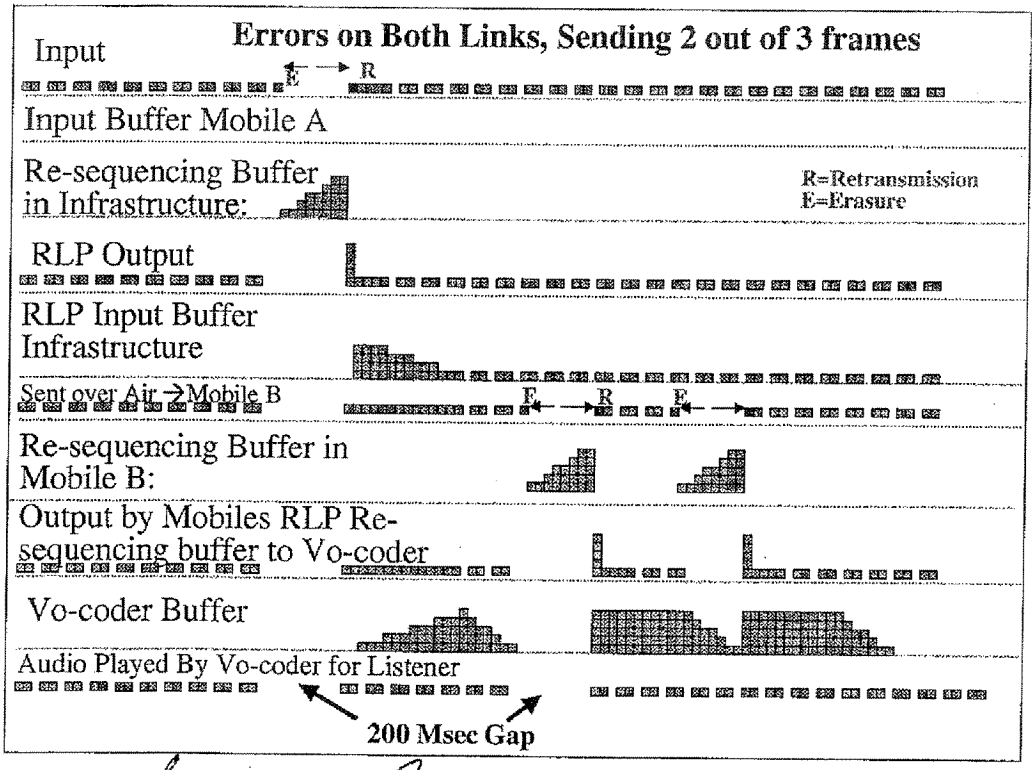

Figure 8: Errors on Speaker's and Listener's Link, Sending 2 out of 3 frames

Inventor _____ 5/24/01 Witness 1 _____

Inventor _____ Witness 2 _____ 5/24/01

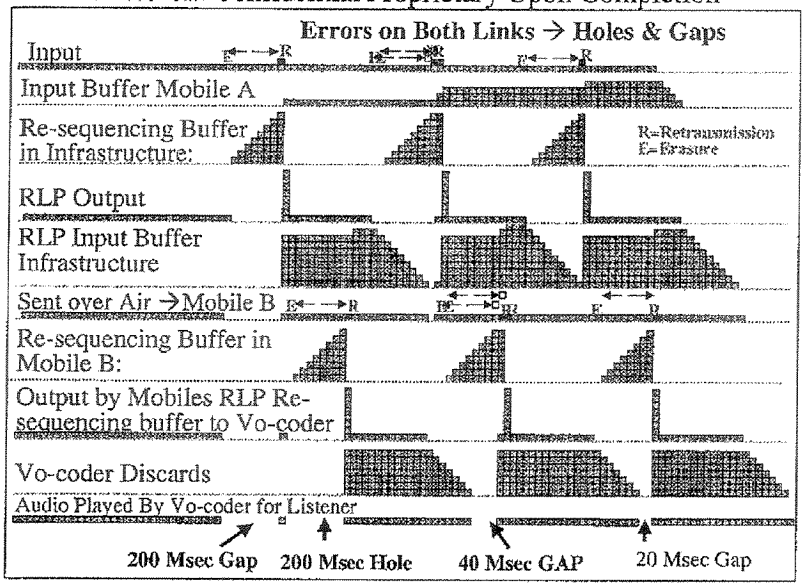

Figure 9: More Errors on Speaker's and Listener's Link, Sending 2 out of 3 frames

Problem:

If one uses RLP with retransmissions, the link quality is acceptable for a much higher FER (and thus smaller RF impact). For example, at 5% FER, the effective FER is 1%. If no retransmissions are used, then a 0.5% FER is need to achieve a 1% effective FER. This results in roughly 40% less power per call (if at 5% FER not 0.5%).

However, using retransmissions, requires that one use a jitter buffer to smooth out the 'big gaps' that will result (see farther below). Normally, roughly 500 milliseconds are required to fill the RLP jitter buffer at the beginning of each call. However, if the speaker starts speaking while the traffic channel is being built, it may only take 100 milliseconds to send the 500 milliseconds of queued voice after the TCH is built. This follows from the assumption that one can send a 4 times the rate the vocoder generates bits & 100msecs or silence occurs after the beep before speech starts. This reasonable, because, using a 9.6 channel (plus a SCH if needed) one can send much faster than the roughly 4.8K I6 vocoder and the roughly 2.4K I12 vocoder. (One can automatically allocate a 19.2 SCH to dispatch calls for the first 500 milliseconds of the call.) Thus, the delay from button push, till speech is heard by the listener can be reduced by 400 msecs (e.g. 500msecs – 400 msecs). If the method in disclosure "Broadcast of Available Talk Groups to Enable Rapid Jitter Buffer Filling" is used, then an even longer 1 second jitter buffer may be used.

In the listening mobile, when frames are outputted by RLP, they will go into a jitter buffer of roughly 500 millisecond in depth (as described above). The frames in this jitter buffer will then be steadily fed into the devocoder and played for the listener.

This jitter buffer may become deeper than required in certain situations. For example, if the beep is played to the speaker prior to the traffic channel setup (via broadcast beep, channel assignment beep, etc – described in other disclosures) then the jitter buffer will fill to be even longer ~ potentially up to over 1 second. Currently, a 420 msec jitter buffer is required, for a 2 RLP session dispatch call. However, this requirement may vary, as the RLP RTT varies, and the implementation changes. For example, if retransmissions are not used, then only a very small jitter buffer is required. Thus, there is definite potential for the jitter buffer to be larger than needed. Conversely, we need the jitter buffer to

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Inventor _____ Witness 2 _____ 5/22/01

be at least the depth required, so it can 'survive' the stops gaps caused by RLP retransmissions – without causing gaps.

4) Describe the invention, including its operation, purpose and environment. (Use separate sheets as required)
   a. Basic jitter buffer:
      a) The buffer at the output of the RLP instance, in the listener serves as a 'jitter buffer'.
      b) When voice traffic first starts arriving, do not play any out, until the jitter buffer depth meets the required depth.
         1. The required depth depends on the number of bearer links using RLP retransmissions, and the RLP RTTs. This information may be communicated to the listener mobile when the link is set up.

   b. Jitter buffer reset when speakers switch:
      a) When one speaker ends, 'reset' the jitter buffer in the listener mobile.
      b) When the voice traffic first starts arriving from a new speaker, do not play any out, until the jitter buffer depth meets the required depth.

   c. Filling jitter buffer after speaker's voice queued while air links are being established.
      a) After last air-link to listener mobile is established, automatically assign the user an SCH of sufficient duration and rate to carry the queued voice.
      b) In listener mobile, while the jitter buffer is filling, use the following two methods so that one can immediately start playing out voice in the listener mobile, prior to the jitter buffer finishing being filled.
         1. "Force aborts to avoid gaps – Scan into resequencing buffer for bearer traffic" method.
            a. In the listener mobile, provide input to RLP, such that it will force an abort if the buffer is about to run dry, by eaves dropping on resequencing queue.
            b. In other words, if jitter buffer about to run dry, then can go into the resequencing buffer. Also let RLP know so it wont ask to retransmit voice information which has already been aborted.
         2. Use a lower FER target (higher gain) while the jitter buffer is filling.

   d. Force aborts to avoid gaps – Scan into resequencing buffer for bearer traffic.
      a) In the listener mobile, provide input to RLP, such that it will force an abort if the buffer is about to run dry, by eaves dropping on resequencing queue.
      b) In other words, if jitter buffer about to run dry, then can go into the resequencing buffer. Also let RLP know so it wont ask to retransmit voice information which has already been aborted.

   e. Simple differentiated QoS in RLP – without changing over the air protocol:
      a) Problem: 2 bearer streams, 1 needs retransmissions and 1 does not (or 1 needs more rounds of retransmissions than the other)
      b) Scan the resequencing buffer for bearer messages of containing vocoded frames (as indicated by their size, the pattern, etc).

Inventor _____ 5/21/07 Witness 1 _____ 5/21/01
Inventor _____ Witness 2 _____ 5/21/01

f. Bound the resequencing buffer size: Modify RLP to
   a) Decrement the NACK timer when erased & DTX frames are received.
      1. This is as opposed to the normal RLP method in which the NAK timer only counts down when non erased non-retransmissions are received.
   b) Not send idle frames

This effectively bound the resequencing buffer size. If frame is older than some amount x, then it will be aborted.

5) **List the closest known technology (attach article, patent, catalog sheet or other documentation).**

6) **Improvement(s) over known technology.**
   a. Basic jitter buffer & Jitter buffer reset when speakers switch:
      a) Eliminates the to two 200 msec large gaps in dispatch calls which use retransmissions, enabling the use of RLP retransmissions and thus the reduced RF impact the enable. See Figure 9 and Figure 10.
      b) Prevents the to two 200 msec large gaps in dispatch calls in subsequent speakers, in multi-party dispatch. For example, after Speaker A stops, and Speaker B starts, listener C will experience an additional pair of 200 msec gaps if the speaker switch invention claim is not implemented.

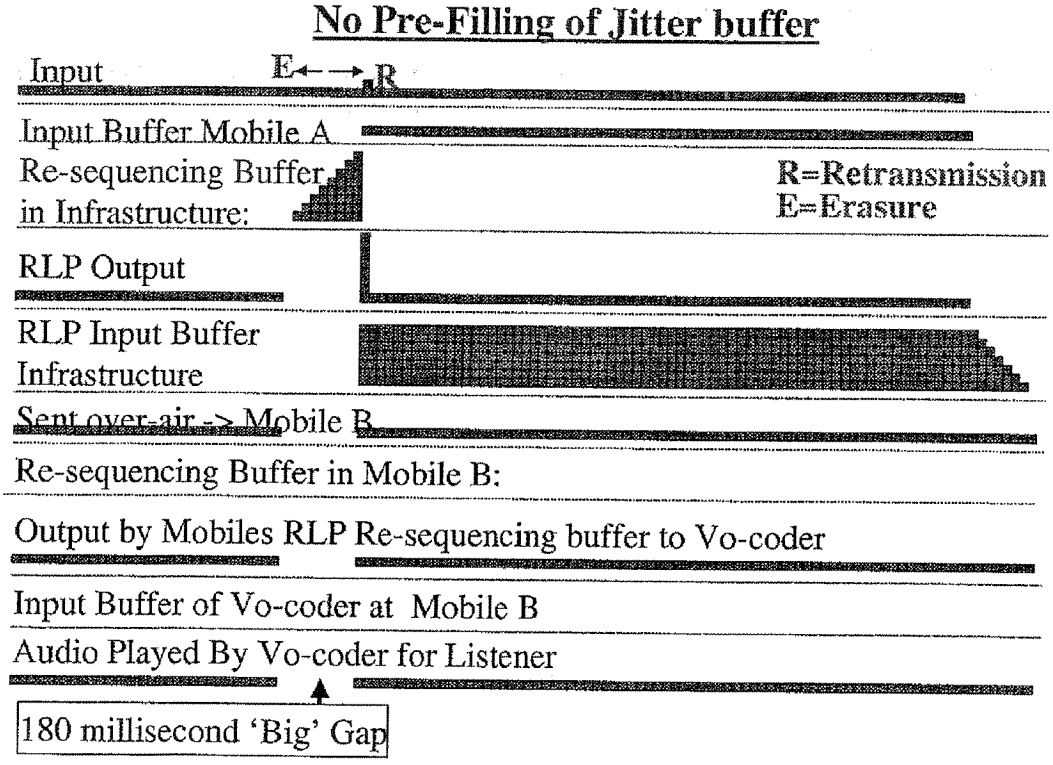

Figure 10

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Inventor _____ Witness 2 _____

Pre-Filling of Jitter buffer – Deep Enough

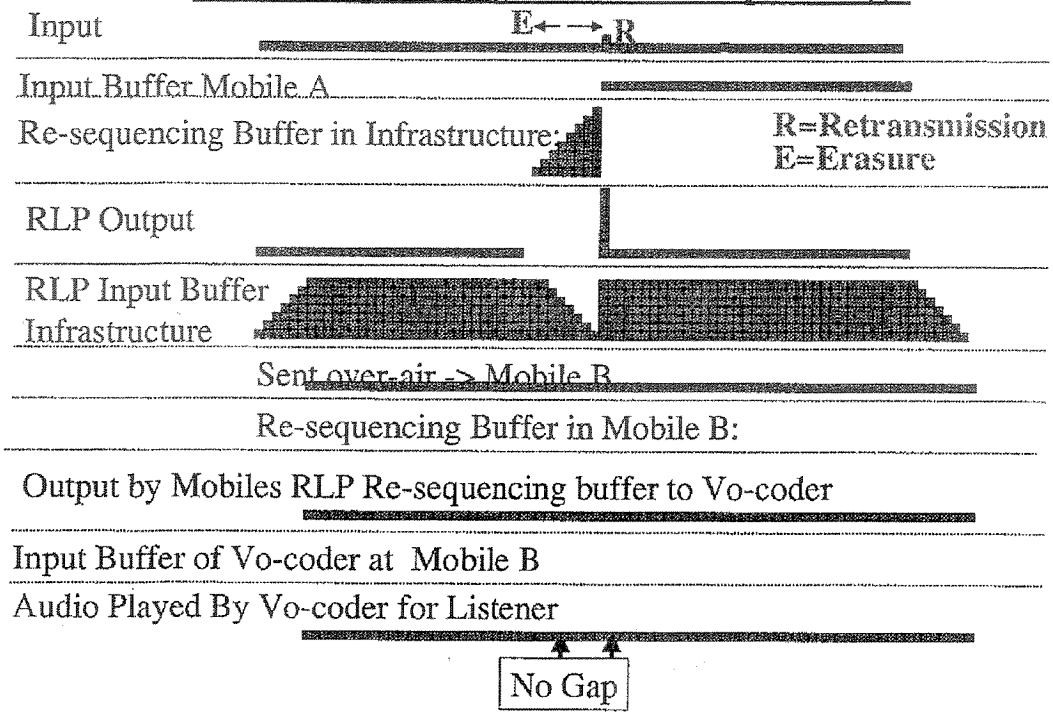

Figure 11

Inventor _____ Witness 1 _____

Inventor _____ Witness 2 _____

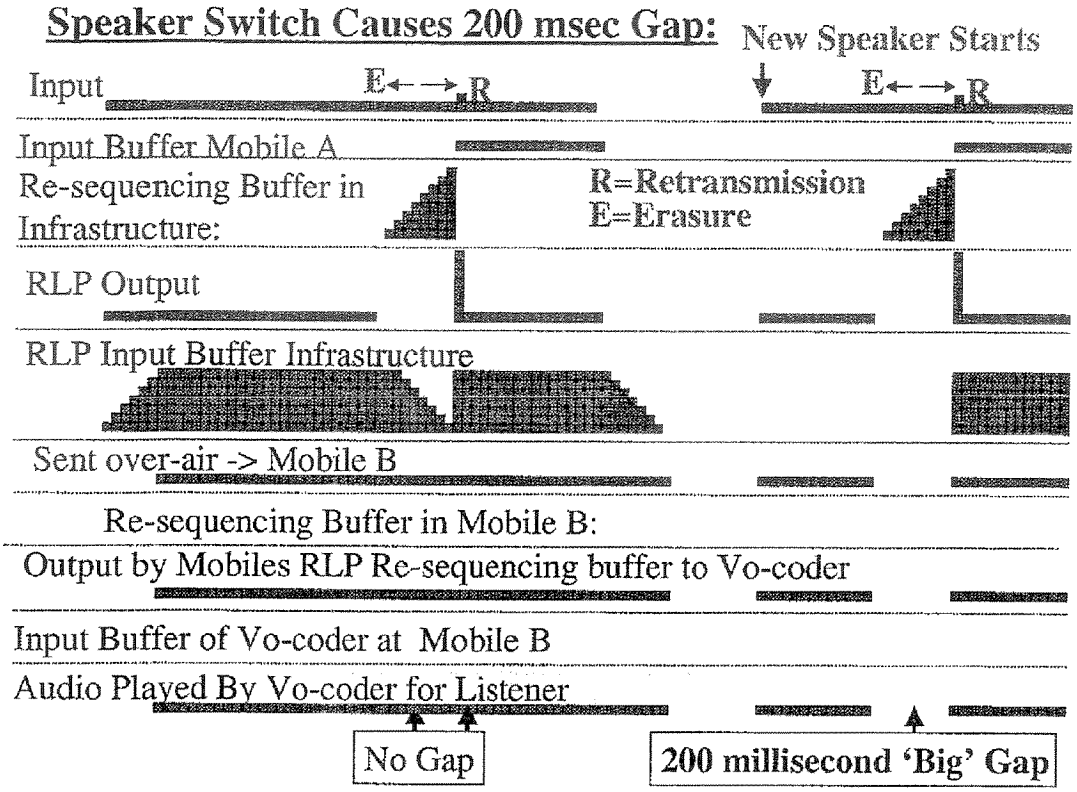

Figure 12

b. Filling jitter buffer after speaker's voice queued while air links are being established.
   a) Allows one to immediately start playing out voice, without waiting at all for the jitter buffer to fill.

c. Force aborts when needed to avoid gaps – Scan into resequencing buffer for bearer traffic.
   a) Enables the benefit of item b. immediately above.
   b) Eliminates long 200 msec gaps when the jitter buffer has run dry.

d. Simple differentiated QoS in RLP – without changing over the air protocol:
   a) Allows one to solve the following problem, without changing the over the air protocol. This is important when signaling and voice share the same link.
      1. Problem: 2 bearer streams, 1 needs retransmissions and 1 does not (or 1 needs more rounds of retransmissions than the other)

e. Bound the resequencing buffer size:
   a) This reduces the jitter buffer size requirement by truncating the tail of the ordered delay distribution of RLP ~ caused by delayed detection (consecutive errors) and NAK timer expansion caused.

7) **What new elements (e.g. components, circuits, process steps) or combination of known elements or software algorithm produced the improvement?**

Inventor _____ 5/24/01 Witness 1 _____ 5/24/01
Inventor _____ Witness 2 _____ 5/24/01

a. Basic jitter buffer:
b. Jitter buffer reset when speakers switch:
c. Filling jitter buffer after speaker's voice queued while air links are being established.
    a) After last air-link to listener mobile is established, automatically assign the user an SCH of sufficient duration and rate to carry the queued voice.
    b) "Force aborts to avoid gaps – Scan into resequencing buffer for bearer traffic" method.
    c) Use a lower FER target (higher gain) while the jitter buffer is filling.

d. Force aborts to avoid gaps – Scan into resequencing buffer for bearer traffic.
e. Simple differentiated QoS in RLP – without changing over the air protocol:
f. Bound the resequencing buffer size:

Inventor _____ 5/21/01 Witness 1 Anthony L. Dean 5/21/01
Inventor _____ Witness 2 _____ 5/21/01